approximately three miles north and west from the city more than 10 inches must have fallen. Between five and six miles north and west from the city's center the rainfall undoubtedly reached 14 inches over a considerable portion of the drainage areas. Nine stations show 15 inches or more.

The heaviest rainfall probably occurred 8 to 10 miles northwest of San Antonio. Beyond this point the rainfall was not so heavy, as shown by the 8-inch gage located 17 miles northwest, where 10 inches were recorded.

It is possible, but hardly probable, that some section of these drainage basins received 20 inches of precipitation in the storm preceding the flood. Two stations show this amount, but much evidence would be necessary before those familiar with rainfall data could accept the figures.

Results of the run-off.—The Olmos, the largest of the three basins, extends back into the hills about 9 miles, so the flood crest on the Apache and Alazan, running from shorter watersheds, reached the city first. The crest on the Olmos came in time to merge with their waters.

The principal loss of life in the city was caused by the Alazan. From practically a dry bed, this stream rose with little warning. Several hundred houses, mostly small structures, were swept along on its waters, wrecked and piled against the railroad trestles below.

The Olmos caused the flood in the business section. This tributary of the San Antonio River carries virtually no water except during wet periods. Estimates show that around 30,000 second-feet moved through the Olmos basin at the peak of the flood. Preliminary figures show that 21,000 second-feet were moving across Houston Street at 1:00 a. m. on the morning of the 10th.

The water rose so rapidly that automobiles were deserted on the streets, and their occupants sought safety in high buildings. Five to nine feet of water stood in the large hotels, theaters, and stores. Great quantities of merchandise were injured, and in many instances swept into the river. The swift currents carried away miles of city pavements and injured or destroyed many bridges.

City water and power services were disabled and rescue work was handicapped by darkness. The loss of life undoubtedly would have been greater but for the proximity and efficient assistance rendered by the United States Army. Pontoons were brought in trucks from Camp Travis, and the Army Engineers quickly bridged the streets with their boats, giving timely aid to many people in precarious positions.

Previous floods.—Nine floods are known to have occurred in San Antonio prior to the flood of September 10, 1921. Lives have been lost and considerable property damage sustained, when varying amounts of water from 4,000 to 20,000 second-feet passed through the city. Careful estimates indicate that during the crest of the 1921 flood a flow around 30,000 second-feet must have been reached.

In the dust-laden archives of the old San Fernando Cathedral at San Antonio, Tex., are the records of a destructive flood which visited this section in 1819. The heights of the water on many old landmarks in and about the city are recorded. Engineers have estimated the discharge for this flood, and the figures do not fall far below those of September, 1921.

In 1845 there was another flood which caused considerable damage, and the city council decided to move the town, but public opinion did not favor this decision.

On March 16, 1865, another severe flood occurred. This flood was preceded by a terrific hailstorm, in which hailstones weighing 2½ pounds fell. Many mules, horses and small animals were killed. People were drowned on Commerce Street from the flood waters following this storm.

The flood of September 10, 1921, stands as the most destructive flood in the history of this valley. Realizing that the conditions previously given could happen again, plans are under consideration by the municipal authorities to prevent a reoccurrence of the catastrophe.

EXCESSIVE RAINFALL AND FLOOD AT TAYLOR, TEX.

By J. P. McAULIFFE, Observer.
[Weather Bureau, Taylor, Tex.]

There occurred at Taylor, Tex., and its vicinity during September 9–10, 1921, the greatest 24-hour rainfall on record for the United States, 23.11 inches, with 23.98 inches in 35 hours. During the night of the 9th–10th, ending with the 7:00 a. m. observation of the 10th, 19.49 inches of rain fell. The period of heaviest rainfall was from 6:45 p. m. to 9:42 p. m. of the 9th, when 10.50 inches were recorded. At this point the tipping bucket was flooded, stopping the automatic register. Rainfall was not so rapid after 10:00 p. m., and after midnight changed to intermittent showers, which continued until about 3:00 a. m. of the 10th, when the rate of fall again became excessive, the rain continuing as a steady downpour until 7:28 a. m., after which it fell at a moderate rate. The times of beginnings and endings of rain, and the total amounts are as follows:

	Inches.
September 9:	
Rain began about 3:30 a. m.	
Total, midnight to midnight	16.11[1]
September 10:	
Rain ended 2:30 p. m.	
Total midnight to midnight	7.87[1]
Total	23.98

Total duration, 35 hours.

[1] Partly estimated; tipping bucket stopped before midnight.

The most remarkable feature of this storm was its duration, covering a period of 35 hours, with an excessive rate over a period of more than 10 hours. Although continuous rainfall at an excessive rate ended shortly after midnight, it did not cease entirely, and from 12 midnight of the 9th to 3:00 a. m. of the 10th there were several showers at an excessive rate, with moderately heavy rain intervening. From 3:00 a. m. of the 10th until 7:28 a. m. rainfall fell at an excessive rate.

From about 9:00 p. m. of the 9th until midnight the streets of Taylor ran 4 feet deep in water at the maximum depth, with an average depth in all but the highest places of from 1 to 3 feet. This condition occurred again from 5:00 a. m. to 7:30 a. m. of the 10th. The waters washed up pavements, filled cellars and basements to overflowing, and carried away bridges, culverts, and houses. The basements of many buildings were filled with water to the ceilings, and it required the services of the city fire pumpers several days to pump the water out.

By 10:00 p. m. of the 9th the waters of Bull Branch had risen to unprecedented height, carrying away the home of J. W. Sillure, corner Porter and Eleventh Streets. The house lodged against a concrete bridge 300 feet east of its site, being practically a total wreck. The homes of B. A. Harcourt and Mrs. Dora Le Bleu, corner Wash-

burn and Eleventh, were swept into the stream and wrecked against the Missouri, Kansas & Texas railroad bridge half a mile farther east. The home of A. B. Norris on the same corner was lifted from its foundations and carried a short distance, but fortunately lodged in the mud and was but slightly damaged. The inmates of all but the Sillure home were unaware of the danger to their property, and were saved from drowning by timely work of neighbors who came to their aid. Bull Branch is usually an arroyo, fordable at any point, running in an easterly direction past the northern limits of Taylor. It has never before menaced property, and the Sillure home has stood near its bank for nearly 40 years. Many small houses in the Mexican section south of the business district were swept from their foundations, but the property damage was not great, and there was no loss of life. Mustang Creek runs through this section.

The greatest loss of life and property occurred in the country surrounding Taylor, on the farms near the San Gabriel River, north of town, and the Brushy Creek, south and east of the city, each stream being approximately five miles from Taylor.

There were three rises in the San Gabriel River. The first came at midnight of the 9th, the second about 5:00 a. m., and the last at 3:00 p. m. of the 10th. The first rise came as a wall of water 4 feet high, thundering down the stream with a roar that could be heard for more than a mile. The water rose at the rate of 2 feet a minute after this until the river was out of its banks. The second and third rises completely submerged the low lands, and put the water to a height never before known. Farmers living in the valleys adjacent to the river were forced to leave hurriedly, some of them being fortunate enough to drive their stock to high ground, but very few being able to save any household goods. Many lives were lost by persons being trapped in their homes, unaware of the flood, as no previous high water had ever reached them. Eighteen houses were counted floating past Circleville Saturday afternoon. Every bridge and culvert, except a few, were swept from their foundations, the majority being total wrecks. The Missouri, Kansas & Texas railroad bridge was severely damaged, and a mile of track washed out.

The towns of Circleville and Jonah, almost on the banks of the San Gabriel River, suffered heavily, nearly all buildings being washed from their foundations, many destroyed, and all being filled with mud to such an extent as to ruin practically everything within.

It is authoritatively stated by many farmers living near the San Gabriel River that the water on September 9–10 was at least 7 feet higher than ever before known. The most trustworthy evidence in this connection comes from Mr. H. T. Stearns, whose people have lived on a farm near the river since 1854. Mr. Stearns is now a man of 84 years, and he states that there have been two floods within his memory that approximated this one in severity, one in 1854 and another in 1868. None of them, however, gave as high water as this one by at least 7 feet. The same statements are made regarding the Brushy and other smaller streams.

To give some idea of the amount of rainfall in this vicinity not reported by the Weather Bureau, the statements of six intelligent and trustworthy farmers living north and east of Taylor should be cited. These farmers usually have barrels for hauling water when droughty conditions prevail. During the drought which preceded the downpour there was much hauling of water, consequently clean barrels were numerous. It is stated by these gentlemen that barrels on farms at different places measuring 36 inches high by 18 inches in diameter were filled to overflowing on the morning of the 10th. It is certain that not more than 2 inches of water were in the barrels prior to the excessive rain, as this is the amount registered at the Weather Bureau station at that time. Allowing for all errors, it seems assured that some 30 inches of rain fell at many places in about 15 hours. These farmers declare that the barrels were empty prior to the beginning of rainfall.

Hutto, 10 miles southwest of Taylor, reported a tornado which damaged two churches, the white Baptist and the colored Baptist, and blew several houses off their foundations. This storm was also reported at Weir, 10 miles northwest of Taylor, and Mr. R. F. Young, cooperative observer at Georgetown, reported the same storm southeast of Georgetown. The time of occurrence was about midnight of the 9th. While this storm has been reported from these places as a "cyclone," it is almost certain that it was a severe squall in connection with the violent thunderstorm then in progress. There were several sudden gusts at Taylor during the same night, the strongest one being 31 miles an hour from the south at 3:11 a. m. of the 10th.

The damage on the Brushy Creek was great. This is a small stream that runs some 5 miles south and east of Taylor. Many Negroes and Mexicans were drowned in this section, and scores were compelled to spend the night in tree tops after being awakened by the flood waters which came into their beds. It was necessary for several persons to climb into the lofts of their houses and gain egress by cutting holes in the roofs.

The waters of the Brushy Creek and Mustang Creek met, the latter creek running just south of Taylor. There was an expanse of water for 10 miles southeast of Taylor on the morning of the 10th. Mustang Creek caused great damage to the International & Great Northern Railroad bridges and tracks.

This remarkable rainfall with its attendant floods and loss of life and property was the result of two thunderstorms of unusual violence. The first thunder was heard in the south at 4:19 p. m. of the 9th, and came at the close of a day that had given continuous rainfall at a slow rate since 3:30 a. m. The thunder in the south at the afternoon hour was of the deep, rolling variety, growing gradually louder and more frequent. By 7:00 p. m. the storm clouds had reached Taylor, and the thunder and lightning were incessant. At 9:45 p. m. thunder became unusually heavy. All during the storm there was a continuous roar, caused by thunder, falling rain, and more or less wind. Neither thunder nor lightning ceased the entire night. Nevertheless, there was a lull in the storm after midnight, and comparative quiet prevailed about 3:00 a. m. Shortly after this another thunderstorm as severe as the preceding one, giving sharper crashes of thunder, rolled up from the south, and at the hour of the morning observation lightning was incessant, and the attendant thunder was deafening. This storm was last heard in the west at 12:00 noon of the 10th. Many houses were struck by lightning, and areas in cotton fields 20 feet square burned by lightning, but the flood damage was so great that very little attention has been paid to damage by lightning. The electric lights in Taylor were put out of commission, and all telephone and telegraph service ceased.

It is a peculiar circumstance that while this downpour occurred from about San Antonio to above Cameron, a southwest-northeast distance of more than 200 miles, Elgin, just 18 miles south of Taylor, received less than 4 inches of rainfall.

In Taylor and vicinity the deaths resulting from the floods totaled 87, while the property losses amounted to about $93,000.